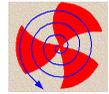


# HIGH SPIN STRUCTURE OF $^{201}\text{Tl}$ ISOTOPE



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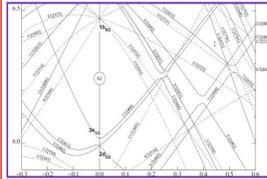
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Interesting features are :

❖  $\pi h_{9/2}$  orbital above the  $Z = 82$  shell closure, is accessible by the odd proton in Tl nuclei for oblate deformation.

❖ Odd-A Tl isotopes: Ground state spin  $\frac{1}{2}$  (unpaired proton occupy the  $3s_{1/2}$  orbital below  $Z=82$ .)



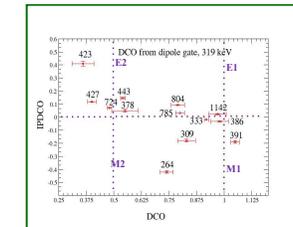
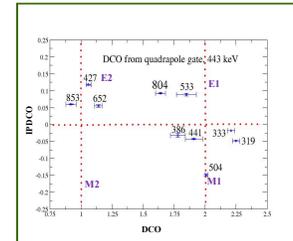
❑ Excited states of  $^{200,201}\text{Tl}$  have been populated:  $^{198}\text{Pt}(\text{Li},x\text{n})$  at  $E_{\text{beam}} = 45 \text{ MeV}$

❑ Target: A self supporting enriched  $^{198}\text{Pt}$  foil having thickness  $1.3 \text{ mg/cm}^2$ .

❑ 15 Clover detectors  
 → two clovers each at  $\pm 40^\circ$  and  $\pm 65^\circ$ , four clovers at  $90^\circ$  and three at  $-23^\circ$ .

❑ Digital DAQ

❑ Trigger :  $\gamma$ - $\gamma$  coincidence at Clover level

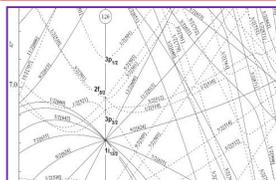
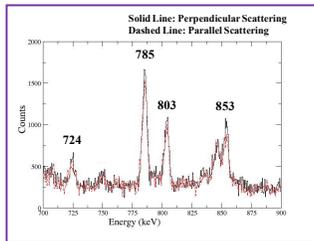


❖ For heavy Tl isotopes neutron number favour oblate deformation since they occupy upper part of the  $\nu i_{13/2}$  orbital.

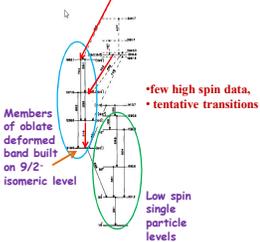
❖ Coincidence :  $\gamma$ - $\gamma$  matrices and  $\gamma$ - $\gamma$ - $\gamma$  cube

❖ Spin assignment : DCO measurement using  $-23^\circ$  and  $90^\circ$  detectors

❖ Parity of levels: Polarization measurement with  $90^\circ$  detectors



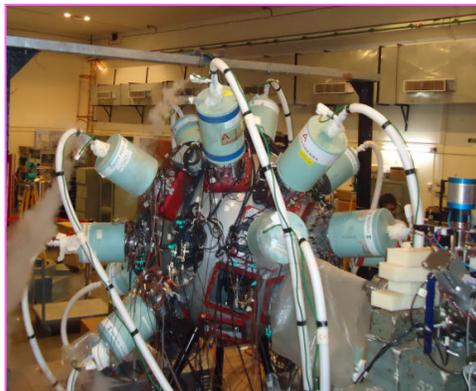
Known Level scheme of  $^{201}\text{Tl}$  before this work



Members of oblate deformed band built on  $9/2^-$  isomeric level  
 • few high spin data, tentative transitions  
 • Low spin single particle levels

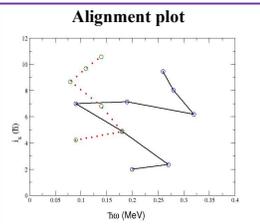
Reaction:  $^{202}\text{Hg}(d,3\text{n})$   
 Coincidence measurement at 24MeV  
 Angular distribution 24 & 25MeV  
 With 3 Ge(Li) detectors [Ref 1.]

## INGA SET UP AT TIFR



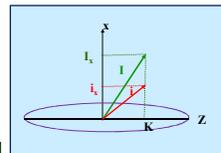
Excitation energy (keV)	$^{195}\text{Tl}$	$^{197}\text{Tl}$	$^{199}\text{Tl}$	$^{201}\text{Tl}$
272	272	272	272	272
274	274	274	274	274
276	276	276	276	276
278	278	278	278	278
280	280	280	280	280
282	282	282	282	282
284	284	284	284	284
286	286	286	286	286
288	288	288	288	288
290	290	290	290	290
292	292	292	292	292
294	294	294	294	294
296	296	296	296	296
298	298	298	298	298
300	300	300	300	300
302	302	302	302	302
304	304	304	304	304
306	306	306	306	306
308	308	308	308	308
310	310	310	310	310
312	312	312	312	312
314	314	314	314	314
316	316	316	316	316
318	318	318	318	318
320	320	320	320	320

Energy level systematic of the  $9/2^-$  oblate bands in odd A  $^{195-201}\text{Tl}$  isotopes.

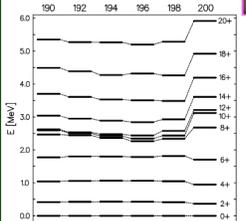


Alignment plot

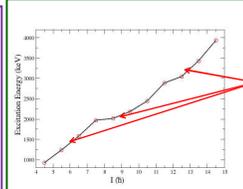
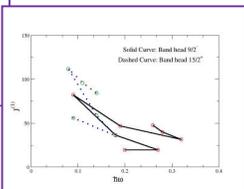
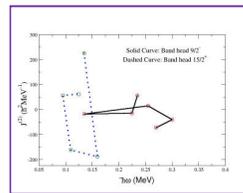
Solid curve : For the  $-ve$  parity band with band head spin  $9/2$   
 Dashed Curve:  $+ve$  parity band with band head spin  $15/2$



- ✓  $^{201}\text{Tl}$ :  $^{200}\text{Hg}$  core + one proton particle
- ✓ For heavy Hg isotopes, excitations energies of levels beyond  $6^+$  are much higher than the lighter ones for same spin
  - due to an energy gap around  $N=120$
  - $\nu i_{13/2}$  orbital is closed
  - a  $\nu i_{13/2}$  two quasineutron band beyond  $8^+$
- ✓ In  $^{201}\text{Tl}$  this band is not seen.
- ✓ In  $^{201}\text{Tl}$  E1 transitions  $-1 \text{ MeV}$  (1142, 785 -keV) are observed, which are connected to the  $-ve$  parity band.
  - one  $\nu i_{13/2}$  excitation
  - similar E1 transitions in  $^{200}\text{Hg}$  core
- ✓ It can be inferred that the possible configuration of the  $+ve$  parity band is  $(\pi h_{9/2}^{-1} \otimes \nu i_{13/2}^{-1} p_{3/2}^{-1})$ .



Systematic of the excitation energy in the even mass Hg isotopes of the  $+ve$  parity yrast states. [Ref 2.]



indicates 3 different configurations

References :  
 [1] M.G. Slocombe et al., NPA 275, 166 (1977).  
 [2] A. G6rgen et al., Eur. Phys. J A 6, 141 (1999).

## Summary

- 29 new transitions are identified.
- Previous tentative 167,427,468,749,785-keV transitions are confirmed here.
- Band built on the  $9/2^-$  isomeric level is extended up to 3934-keV.
- 3 different configurations are observed for the above band.
- Significant extension is made for the side bands.

## Possible configurations:

- One quasiparticle ( $\pi h_{9/2}^{-1}$ )
- Three quasiparticle ( $\pi h_{9/2}^{-1} \otimes \nu f_{5/2}^{-2}$ )
- Five quasiparticle ( $\pi h_{9/2}^{-1} \otimes \nu f_{5/2}^{-2} p_{3/2}^{-2}$ )

## Acknowledgement :

We are grateful to the BARC-TIFR Pelletron staff for providing very stable  $^{201}\text{Tl}$  beam of desired energy. We acknowledge B.S. Naidu, S.K. Jadav and R. Donthi for their technical support during the experiment. Thanks to all members of the INGA collaboration to setup the facility. Last but not the least, we want to express our sincere gratitude to Prof. R.G. Pillay for his valuable guidance and encouraging discussion.